March 1976

FOOD PREFERENCES AND FOOD LOCATION BY POCKET GOPHERS IN IDAHO

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ABSTRACT: Pocket gophers (Thomomys talpoides) in environmental systems adapted readily to laboratory conditions. The laboratory equipment is described in this paper. Results are reported, including data on food consumption as it varies with the activity patterns of the gopher and the variation between individual gophers. One gopher used an average of 52 g of food per day for a 131-day period, but during an extremely active 17-day period, the gopher consumed approximately its own weight in food each day (75 g).

The experimental setup is described for food location experiments and results indicate that gophers locate their food primarily by odor. Test animals react very quickly (in seconds or minutes) to odor stimuli if the gopher's food cache is depleted and the animal is hungry.

EXPERIMENTAL EQUIPMENT

A controlled gopher environment was designed where soil temperature, soil moisture, and the temperature and humidity of the air above the soil were controlled. Available food was controlled and measured, and behavioral responses of the gopher were monitored and observed.

Laboratory facilities consisted of a series of "ant farm-like" environmental chambers. Each unit was about 2.44 m by 1.22 m in size, and 85 mm from the glass front to the wooden backing. Soil filled the space in the center, with 6.5-mm pipes mounted 150 mm apart, behind the soil layer to carry coolant through the system. Different temperature gradients within the soil were maintained by circulating coolants of different temperatures through each pipe. An enlarged section at the top of each unit provided a 203-mm-wide shelf or soil surface. Plants were maintained in the upper soil layer, and a plastic cover allowed control over the humidity and temperature of the air above the soil. The plastic cover provided light penetration for plants growing in the upper soil portion.

Each basic unit was connected to others by a 75-mm PVC pipe at two different soil depths. Gophers adapted readily to the systems, using the pipes as tunnels and creating burrows in the soil behind the glass. A special soil mix of milled peat moss, white sand, and silt loam soil allowed easy visibility to the tunnel system if the proper soil moisture was maintained. With proper soil moisture, the pocket gopher tunnels remained in the soil without collapsing.

Behavior patterns such as food use and food consumption were readily observed by dim red lights through the glass. Pressed wood covers over the glass protected the burrow system except during observations.

In this study, a basic experimental unit consisted of four environmental units, each connected to the next unit by two PVC pipes, one about 150 mm below the soil surface and another about 457 mm below the surface. Length of these PVC connecting pipes varied from about 0.5 to 1.8 m. Inside each connecting PVC pipe was a 45-mm piece of piano wire connected to a switch mounted above the pipe. A gopher travelling through the pipe actuated the switch, recording this movement on a one-week chart. Six switch points in one four-unit system recorded on one chart each week.

Pocket gophers adapted readily to this system, and several gophers lived more than two years in the laboratory. This is not to suggest that this is a normal pattern for wild gophers. The normal life span is probably less than one year, but in the laboratory, factors of stress such as predation and competition for food and space have been removed. The laboratory system was not designed to duplicate a field situation, but to create standard, repeatable conditions as a base for measuring behavioral responses of the gophers.

Gophers used as test animals were trapped from forest environments in northern Idaho, where severe tree damage is caused by gophers.

RESULTS AND DISCUSSION

Food Consumption

In these tests, all food items presented to gophers were weighed, including live trees and other plants growing in the surface soil. Food caches were periodically removed and the items weighed to measure unconsumed foods. Residual parts of trees and other plants not completely consumed were also weighed.

Gophers were weighed at least each two weeks, and sample weight trends are shown in Figs. 1, 2, and 3. More gophers showed weight trends illustrated in Figs. 2 and 3 when they were actively digging and living in a burrow system. Some showed initial increase, then tapered off in weight (Fig. 1).

Food consumption is plotted on the same figures as mean daily consumption for each two-week consumption period. For most gophers, food consumption tapered off as weight increased (Figs. 2 and 3). Other gophers were more erratic, as Fig. 1 indicates. Generally, gophers tended to consume more food and gain more weight during periods of vigorous activity such as when burrow systems were being extended or repaired. Food consumption for one gopher, no. 11-72, was recorded for 131 days. When initially trapped on 14 September, he weighed 71 g. For the first days, average daily consumption was 69.7 g per day. During this period, carrots, dandelion (Taraxacum officinale), grand fir (Abies grandis), ponderosa pine (Pinus ponderosa), and Douglas fir (Pseudotsuga menziesii) made up the major part of his diet. This gopher preferred grand fir over ponderosa pine, and Douglas fir least of the trees. From 10 November to 27 November, this gopher consumed 1,266 g of food, an average of 74.5 g per day. At the end of the period, the gopher weighed 75 g. The gopher continued to gain weight though he consumed less. By 30 January, he weighed 92 g. Consumption rate was 31.2 g per day in February and 29.6 g per day in March. By late April, after a series of ponderosa pine preference tests (Cummins 1975), he weighed 70 g, nearly his initial weight. During the 131-day period of record, this gopher averaged 52.0 g of food per day.

During test periods, other gophers were on diets including Montana pea (Thermopsis montana), fireweed (Epilobium angustifolium), mullein (Verbascum thapsis), yarrow (Achiilea lanulosa), geum (Geum macrophyllum), and usually a supplement of carrots. All seemed important as foods although preferences varied with individual gophers.

Activity Patterns

Gopher activity was recorded by the system of relay switches and time chart described above. Two-hour activity periods were used in plotting results. Twelve minutes of constant activity followed by rest for the remainder of the two-hour period resulted in 10 percent activity which is the base scale (Figs. 4 and 5).

Relative weekly activity for two gophers was compared in Fig. 4, one for a 5-week period, and one for 14 weeks. Gopher no. 11-72 (Fig. 4) was the same one for which 131 days of food consumption data is described above. The 17-day period of greatest food consumption occurred within weeks 7, 8, and 9 on the mean weekly activity scale (Fig. 4). Activity during this period was less than during weeks 3, 4, 5, 12, and 13, when food consumption was less.

This indicates an apparent lack of correlation between activity and food consumption, but may be explained by the kinds of activity involved. Active digging may be confined to one unit of the system without the gopher activating the relays. Active food-gathering did activate relays since gophers were travelling frequently through the tunnel system. Direct observation of activity was used to interpret activity patterns recorded on the charts.

Daily activity revealed differences between gophers more than did weekly means. Fig. 5 compares 4 gophers. Gopher no. 6-72 was a daytime gopher, while no. 5-72 was more active in late afternoon and night. During the first 1 to 2 weeks in captivity or after being released in a burrow system, gophers were very active; gophers no. 6-72 and 9-72 showed this pattern in contrast to the two held in captivity for 40 and 135 days. As a gopher developed its burrow system to its satisfaction and was apparently secure, it was less active. In some cases, little or no above-ground disturbance was evident for several weeks unless the only food source was on the surface. In fact, surface sign told very little about the actual activity of gophers.

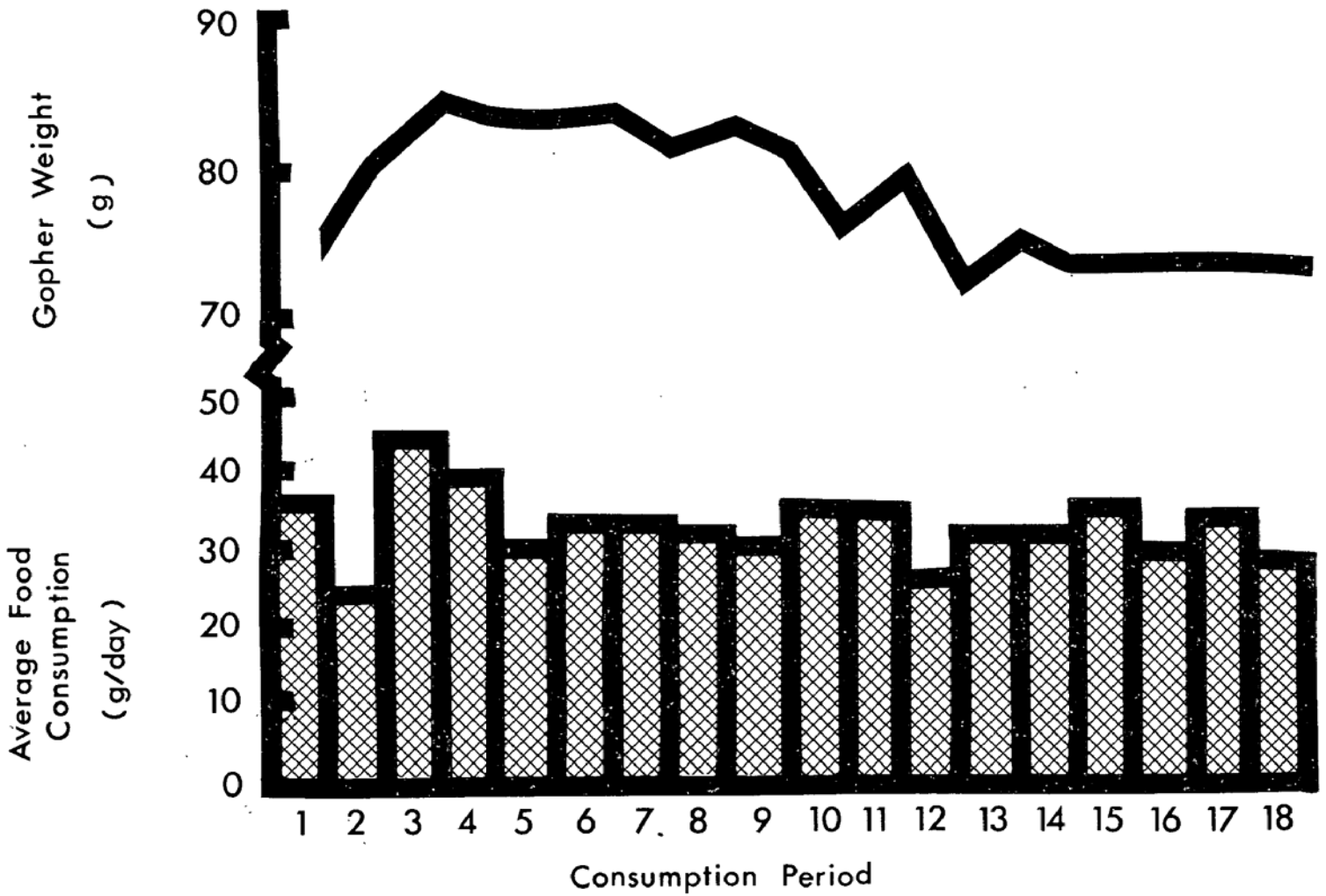

Figure 1. Weight and food use of gopher no. 13-72.

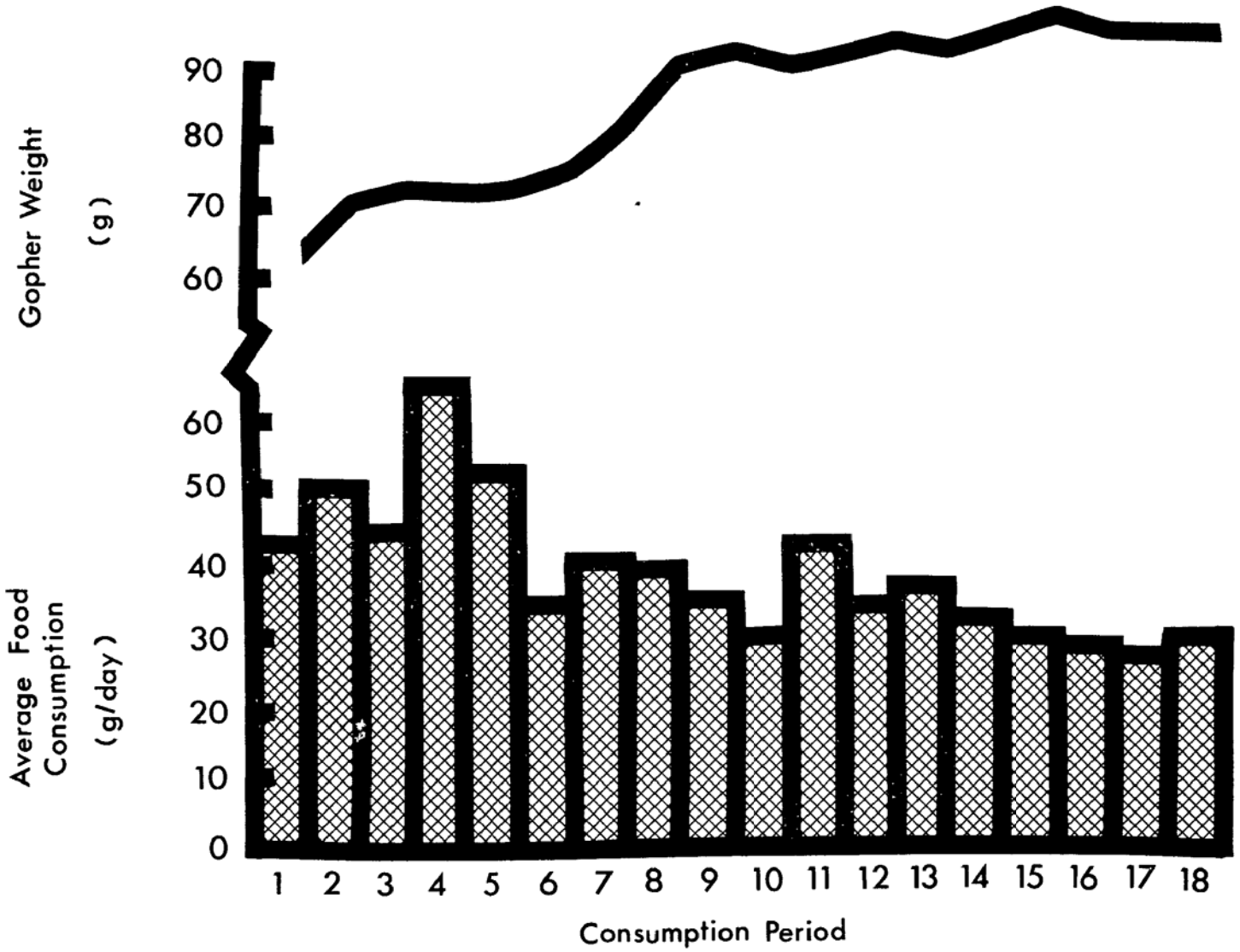

Figure 2 Weight and food use of gopher no 14-72

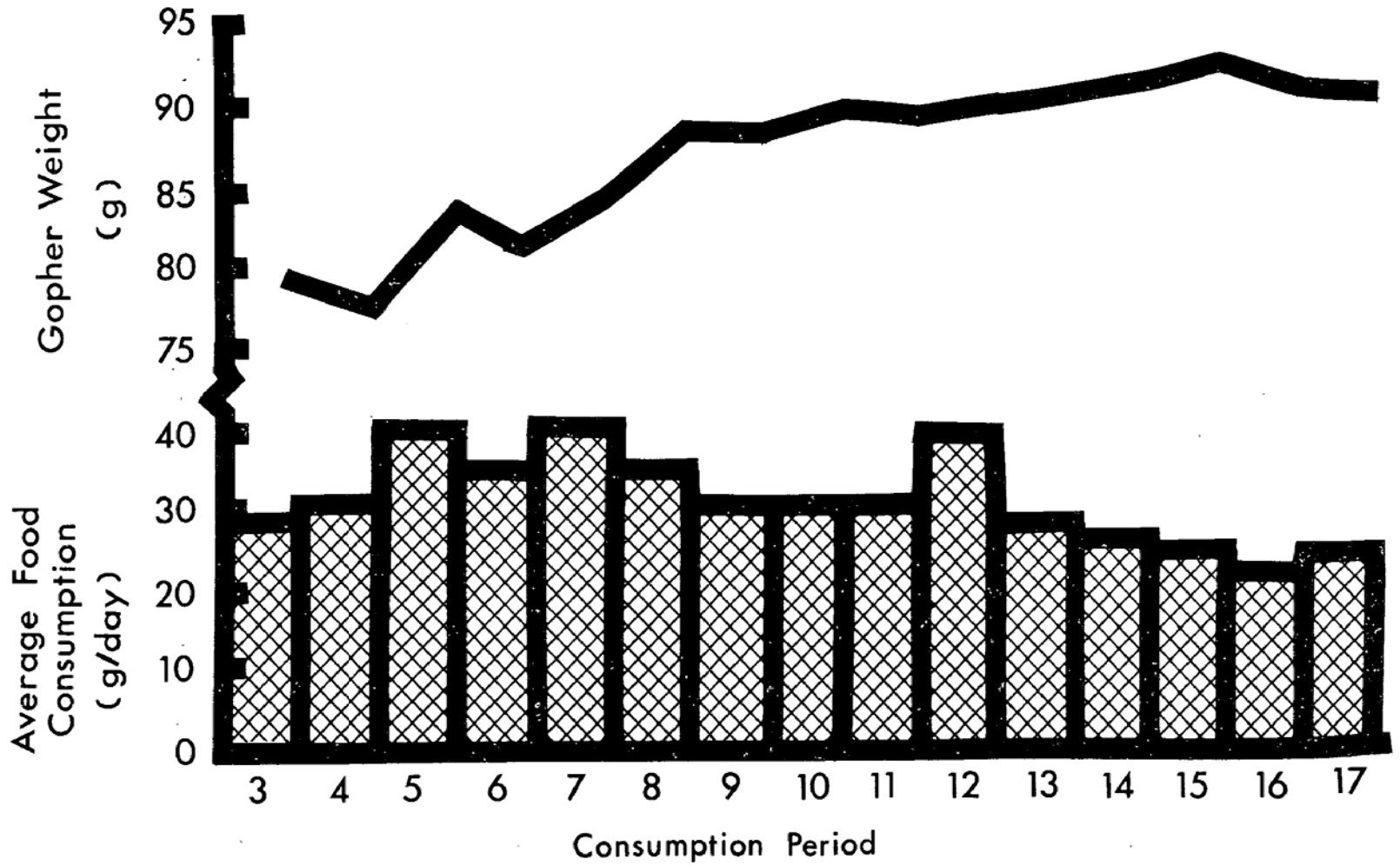

Figure 3. Weight and food use of gopher no. 15-72.

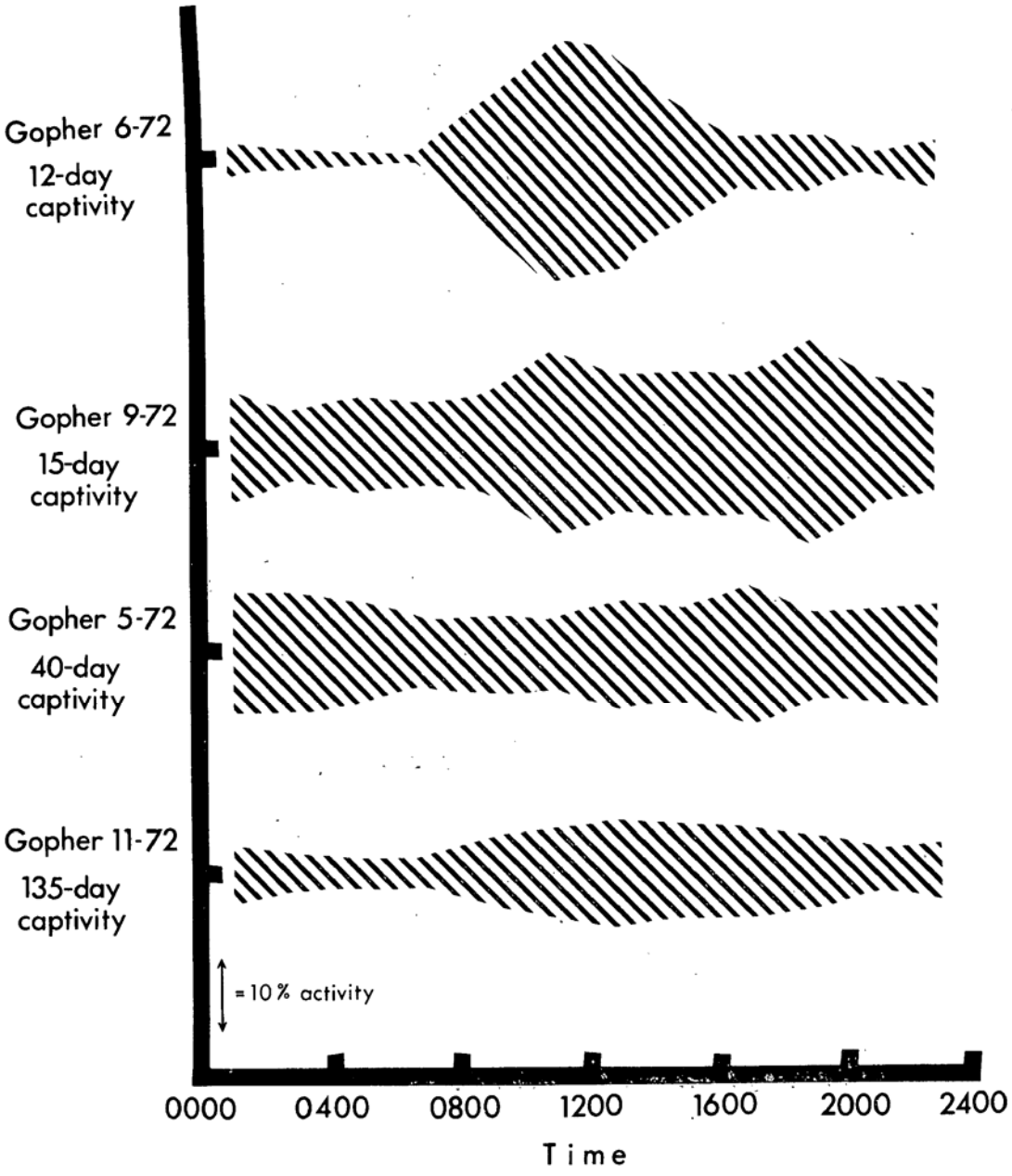

Figure 4. Relative diurnal activity for different gophers.

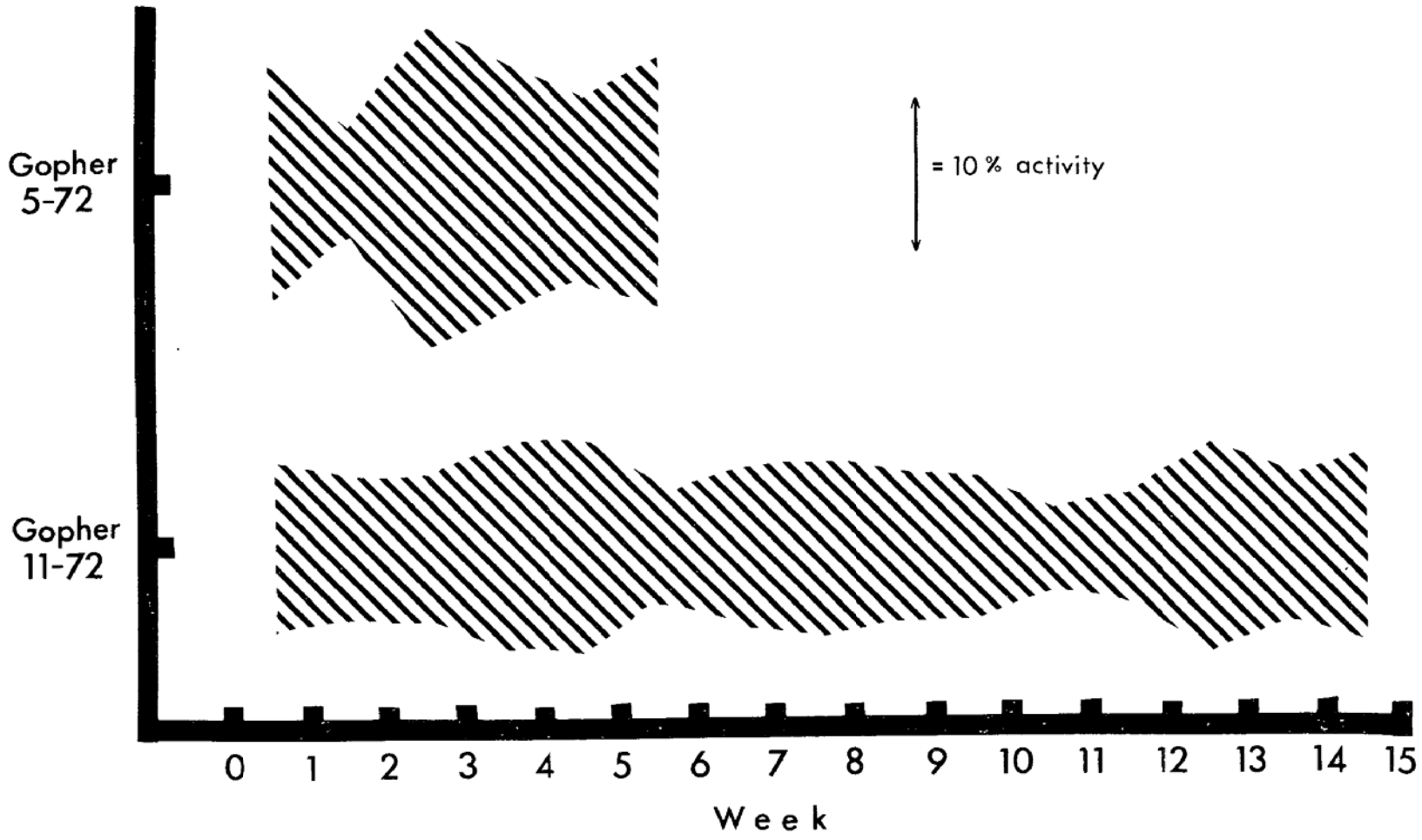

Figure 5. Mean relative weekly activity.

Food Location

Experiments designed to show how gophers locate foods utilized air bubbled through warm water containing the juices of foods being tested. Foods were first combined with the water in a blender. Air bubbled through the dilute juice with a hand pump yielded a known volume of gas, which was then injected into the soil through a hollow fiberglass tube. Points were chosen randomly at standard distances from a burrow. Gophers were observed under dim red lights and responses recorded on videotape. Each test was conducted while the gopher was resting or sleeping in the nest. If the gopher was short of food and its food cache depleted, the response to the injected odor was within 10 to 15 seconds. If the gopher's food cache was full and it was apparently not hungry, a much slower response or no response at all was noted. Based on a limited number of tests, carrot odor produced the most obvious responses.

Applications To Control

Laboratory studies have shown that individual gophers differ greatly in amount of food consumed and preference for various foods. One application of these results to baiting programs is that one kind of food or bait will not be adequate. A number of kinds of bait or rebaiting with new foods may be necessary. It is also evident that gophers locate food by its odor. Baits with the greatest amounts of odor are probably the best attractants. Fresh carrot juice is the most effective we have found in limited testing.

Activity patterns of gophers do not correspond to above-ground sign. It has often been said that gophers are most active in early morning and evening. This is usually not the case, but with some gophers, mound-building is done at these times while other activity takes place around the clock. Gophers are usually active day and night with short rest periods. A gopher secure in a burrow system may leave no above-ground sign for months at a time. I have observed gophers tunneling without disposing of soil above ground but packing it at one end of the tunnel while removing it from the other. One gopher dug 4.8 m of tunnel in one hour by this method when first released in a burrow system.

The open-hole method is often used to tell when gophers are present. We have found that nearly all gophers will leave a tunnel open when the relative humidity of the air at ground level is 94% or more. This suggests that the open-hole technique has limited use during rainy periods.

LITERATURE CITED

CUMMINS, E.B. 1975. Pocket gopher feeding preferences for ponderosa pine strains. M.S. Thesis. Univ. Idaho, Moscow. 51pp.